IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

OFFICIAL

In re application of:	:	
KCC Group Limited for Non-signing	:	
Inventor David John Parkinson	:	
Serial No.: 10/589,940	:	
PCT No.: PCT/GB05/00718	:	Group Art Unit: 1724
International Filing Date: 25 Feb. 2005	:	
Priority Date: 27 February 2004	:	Examiner:
For: CYCLONE ASSEMBLY AND	:	
METHOD FOR INCREASING	:	Docket No.: KCC-030815 (PET-1018US)
OR DECREASING FLOW	:	
CAPACITY OF A CYCLONE	:	Date: October 12, 2007
SEPARATOR IN USE	:	

RENEWED PETITION IN SUPPORT OF APPLICATION FILED UNDER 37 CFR §1.47(b)

Mail Stop PCT
Commissioner for Patents
Office of PCT Legal Administration
P. O. Box 1450
Alexandria, Virginia 22313-1450

This is a *Renewed* Petition for acceptance of an application where the sole inventor refuses to execute the application for patent. A Decision was given 11 September 2007 by Attorney Advisor Ms. Erin P. Thomson on Applicant's original

I hereby certify that this correspondence, and any attachments referred to, is being deposited with the United States Postal on this 12 day of October 2007 in an envelope as "Express Mail Post Office to Addressee" Mailing Label No. EV835824061US addressed to: Mail Stop PCT, Commissioner for Patents, Office of PCT Legal Administration, P.O. Box 1450, Alexandria, Virginia 22313-1450

12 OCTOBER 2007 — David L. Mossman — 12 OCT 2007

Date of Deposit — David L. Mossman — Date

Petition Under 37 CFR §1.47(b) filed in the United States Patent and Trademark Office on 27 June 2007. Ms. Thomson found that of the six required items, item (2) had not been satisfied; the other five items having been satisfied. Ms. Thomson found that the Applicant did not indicated that Mr. Parkinson was provided with a complete copy of the application papers, including the oath or declaration and that he failed to return a signed oath or declaration. The Decision set a time period for submitting a Renewed Petition of two (2) months to expire 11 November 2007.

In support of the Renewed Petition, the following are presented:

(1) Fee

The petition fee of $200.00 (and a one-month extension of time fee of $120.00 for a total of $320.00) were previously paid by the Fee Transmittal (PTO/SB/17) filed 27 June 2007. Because this Renewed Petition is being filed before the expiration of the time period on 11 November 2007, and because the petition fee was earlier paid, the Applicant believes that no additional fees are necessary at this time. However, if any additional fees are due with respect to the entry of this Renewed Petition and submissions attached hereto, Ms. Thomson is authorized to charge such fees to Madan, Mossman & Sriram, P.C. Deposit Account No. 13-0010 (PET-1018US).

(2) Factual Proof that the Inventor Refuses to Execute the Application

A. A new Declaration in Support of Renewed Petition for Application Filed Under 37 CFR §1.47(b) signed by Ms. Sarah Irish, and Exhibits A-H attached thereto, are respectfully submitted herewith;

B. The facts surrounding the additional efforts to obtain sole inventor David John Parkinson's signature on a Declaration for the subject application and the refusal of Mr. Parkinson to sign the application are established by Ms. Sarah Irish's Declaration attached hereto and the Exhibits referred to therein attached thereto. These efforts are in addition to the efforts outlined in her Declaration filed with the original Petition on 27 June 2007.

1. Sarah Irish is a Technical Assistant for N. J. Akers & Co., a law firm in the United Kingdom concerned with patents and trademarks, having a place of business at 7 Ferris Town, Truro, Cornwall TR1 3JG, United Kingdom.
2. Mr. David John Parkinson is the named sole inventor in the above-identified patent application.
3. To Ms. Irish's knowledge (and the knowledge of the undersigned as well), Mr. Parkinson's last known residence address is:

   Arodene
   Walton Down
   Walton-in-Gordano
   Clevedon
   North Somerset BS21 7AR
4. On 17 September 2007 Ms. Irish sent to Mr. Parkinson at the above address a letter (copy attached to her Declaration as Exhibit A) asking that he review the Declaration and Power of Attorney for the US attached thereto (copy attached thereto as Exhibit B) along with a copy of the application, as PCT publication WO 2005/082541 A1 (copy attached thereto as Exhibit C), and sign the Declaration and Power of Attorney and return it to her in an enclosed SAE (self-addressed envelope). This letter and its attachment were delivered to Mr. Parkinson 17 September 2007 as shown on the proof of delivery, Exhibit D, signed for by "P A Parkinson".
5. Also on 17 September 2007 Ms. Irish sent to Mr. Parkinson at his work address:

   DPS (Bristol) Ltd
   Serbert Way
   Portishead
   Bristol BS20 7GF

   a letter substantially similar to her letter referred to above (Exhibit A) of 17 September 2007, (attached thereto as Exhibit E) asking again that he review the Declaration and Power of Attorney for the US attached thereto (copy attached hereto as Exhibit B), along with a copy of the application, as PCT

publication WO 2005/082541 A1 (copy attached thereto as Exhibit C), and sign the Declaration and Power of Attorney and return it to her in an enclosed SAE. This letter and its attachment were delivered to Mr. Parkinson 17 September 2007 as shown on the proof of delivery, indicating receipt by "J Lock", copy attached thereto as Exhibit F.

6. Additionally on 17 September 2007 Ms. Irish sent to Mr. Parkinson an email message at his work address of davidparkinson@dps-global.com; a copy of the email being attached thereto as Exhibit G. The text of this message was substantially similar to her two postal letters of 17 September 2007, again asking him to review the Declaration (Exhibit B), an electronic copy of which was attached thereto, along with a copy of the application, as PCT publication WO 2005/082541 A1, and electronic copy being attached thereto (copy attached thereto as Exhibit C), and sign the Declaration and Power of Attorney and return it to her.
7. Later on 17 September 2007, Ms. Irish received an automatically generated Delivery Status Notification that her email was successfully delivered to the recipient at "davidparkinson@dps-global.com", which, as noted, is Mr. Parkinson's work email address, a copy of which Delivery Status Notification is attached thereto as Exhibit H.
8. As of the 11 October 2007 date of her Declaration, Ms. Irish had not received a signed copy of the Declaration from Mr. Parkinson (or any other communication). The date of 11 October is at least two weeks after the delivery dates of the physical mail on 18 September and the email on 17 September. She and the undersigned must thus conclude that Mr. Parkinson has refused and continues to refuse to sign the Declaration.

(3) Statement of Last Known Address of Inventor

The Applicant would thus further respectfully request and petition that based on the above facts and documents that the conclusion be reached that the inventor Mr. Parkinson was provided not once, but three times, with a complete copy of the application papers, including the Declaration and Power of Attorney, and that he has

failed to sign the application, and that item (2) has now been satisfied, all of the six required items being satisfied for grant of the Petition.

Prayer for Relief

In view of these facts, the Applicant/Petitioner KCC Group Limited respectfully petitions that the United States Patent and Trademark Office accept the application because the inventor has refused to sign, and accept the application on behalf of one showing sufficient proprietary interest in the matter justifying such action, necessary to preserve the rights of said party.

The PTO Attorney Advisor Ms. Thomson is invited to call the undersigned attorney for any reason, including helping expedite the granting of this Petition, or if there are any questions.

Respectfully submitted,

Date: 12 OCT. 2007

David L. Mossman
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Houston Texas 77057

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

OFFICIAL

In re application of:	:	
David John Parkinson	:	
Serial No.: 10/589,940	:	
PCT No.: PCT/GB05/00718	:	Group Art Unit: 1724
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METHOD FOR INCREASING	:	Docket No.: KCC-030815 (PET-1018US)
OR DECREASING FLOW	:	
CAPACITY OF A CYCLONE	:	
SEPARATOR IN USE	:	

DECLARATION IN SUPPORT OF RENEWED PETITION FOR APPLICATION FILED UNDER 37 CFR §1.47(b)

Mail Stop PCT
Commissioner for Patents
Office of PCT Legal Administration
P. O. Box 1450
Alexandria, Virginia 22313-1450

This is a Declaration in support of a Renewed Petition for acceptance of a Declaration and Power of Attorney filed by a person having sufficient proprietary interest in this matter justifying such action as agent on behalf of a non-signing sole inventor. In support of the Petition, the following supporting facts are presented:

I hereby certify that this correspondence, and any attachments referred to, is being deposited with the United States Postal on this 12 day of OCTOBER 2007 in an envelope as "Express Mail Post Office to Addressee" Mailing Label No. EV835824061US addressed to: Mail Stop PCT, Commissioner for Patents, Office of PCT Legal Administration, P.O. Box 1450, Alexandria, Virginia 22313-1450

12 OCTOBER 2007
Date of Deposit

David L. Mossman 12 OCT. 2007
David L. Mossman Date

1. I, Sarah Irish, am a Technical Assistant for N. J. Akers & Co., a law firm in the United Kingdom concerned with patents and trademarks, having a place of business at the address below my signature *infra*.

2. Mr. David John Parkinson is the named sole inventor in the above-identified patent application.

3. Following up my efforts to have Mr. Parkinson sign the subject Declaration as set forth in my Declaration of 10 May 2007, submitted with the original Petition in Support of Application Filed Under 37 CFR §1.47(b) filed with the Office of PCT Legal Administration on 27 June 2007, my subsequent additional efforts to have Mr. Parkinson sign the subject Declaration are as follows:

4. To my knowledge, Mr. Parkinson's last known residence address is:

   Arodene
   Walton Down
   Walton-in-Gordano
   Clevedon
   North Somerset BS21 7AR

5. On 17 September 2007 I sent to Mr. Parkinson at the above address a letter (copy attached hereto as Exhibit A) asking that he review and sign the Declaration and Power of Attorney for the US attached thereto (copy attached hereto as Exhibit B), along with a copy of the application, as PCT publication WO 2005/082541 A1 (copy attached hereto as Exhibit C) and return it to me in an enclosed SAE (self-addressed envelope). This letter and its attachment were delivered to Mr. Parkinson 18 September 2007 as shown on the proof of delivery, signed for by "P A Parkinson", copy attached as Exhibit D.

6. On 17 September 2007 I sent to Mr. Parkinson at his work address:

DPS (Bristol) Ltd
Serbert Way
Portishead
Bristol BS20 7GF

a letter substantially similar to my above-identified letter of 17 September, (attached hereto as Exhibit E) asking again that he review and sign the Declaration and Power of Attorney for the US attached thereto (copy attached hereto as Exhibit B), along with a copy of the application, as PCT publication WO 2005/082541 A1 (copy attached hereto as Exhibit C) and return it to me in an enclosed SAE. This letter and its attachment were delivered to Mr. Parkinson 18 September 2007 as shown on the proof of delivery, signed for by "J Lock", copy attached as Exhibit F.

7. On 17 September 2007 I sent to Mr. Parkinson an email message at his work address of davidparkinson@dps-global.com; a copy of the email being attached hereto as Exhibit G. The text of this message was substantially similar to my previous two postal letters of the same date, 17 September 2007, again asking him to review and sign the Declaration (Exhibit B), an electronic copy of which was attached thereto, along with an electronic copy of PCT publication WO 2005/082541 A1 (copy attached hereto as Exhibit C), and return it to me.

8. Later on 17 September 2007, I received an automatically generated Delivery Status Notification that my email was successfully delivered to the recipient at "davidparkinson@dps-global.com", which, as noted, is Mr. Parkinson's work email address, a copy of which is attached hereto as Exhibit H.

9. As of the date of this Declaration below next to my signature, I have not received a signed copy of the Declaration from Mr. Parkinson, or any communication in response to my post letters or email of 17 September 2007. I conclude that Mr. Parkinson continues to refuse to sign the

Declaration.

10. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application cited above or any patent issued thereon. Further Declarant sayeth not.

Respectfully submitted,

Date: 11 October, 2007

S. M. [signature]

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Exhibit A

Mr. David Parkinson
Arodene
Walton Down
Walton-in-Gordano
Clevedon
North Somerset
BS21 7AR

COPY

Via special delivery

17 September, 2007

Dear Mr. Parkinson

Our firm represents Cooper Cameron, Petreco International and KCC Group Limited with regard to Intellectual Property including various patent matters.

Further to recent correspondence we would be most grateful if you could review and sign appropriately the enclosed combined Declaration and Power of Attorney for the US. As you may be aware these documents are required under American law for patents filed in the United States of America.

Please could you sign the document as indicated and return to us via the enclosed SAE as a matter of some urgency. If you have any queries regarding this document please do not hesitate to contact Mr. Noel Akers of this office.

I also enclose a copy of the PCT publication involved in this case, WO 2005/082541 A1.

Your assistance in this matter is greatly appreciated.

Yours sincerely

Sarah Irish

Encl: Combined Declaration and Power of Attorney
PCT publication WO 2005/082541 A1

Exhibit B

Docket No. DPS-030815US
PET-1018

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As the below named inventor, I hereby declare that:

My residence, post office address and citizenship are stated below my name.

I believe that I am the original, first and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled **"Cyclone Assembly and Method for Increasing or Decreasing Flow Capacity of a Cyclone Separator in Use"** the specification of which is being submitted under 35 USC 371, with an internationally filing date of February 25, 2005.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Sec. 1.56 (a).

I hereby claim foreign priority benefits under Title 35, United States Code, Sec. 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

PRIOR FOREIGN APPLICATION(S)

NUMBER	COUNTRY	(DAY/MONTH/YEAR FILED) PRIORITY CLAIMED	YES	NO
PCT/GB05/000718	WO	25 February 2005	XX	
0404417.8	GB	27 February 2004	XX	

I hereby claim benefit under Title 35, U.S.C., Sec. 120 of any United States application or under Title 35, U.S.C., Section 119(e) of any provisional application listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in any prior United States application in the manner provided by the first paragraph of Title 35, U.S.C., Sec. 112. I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

SERIAL NO.	FILING DATE	STATUS

We hereby appoint the Practitioners named below:

1. Manish Vyas, Reg. No. 54,516
2. Peter Bielinski, Reg. No. 29,282
3. David L. Mossman, Reg. No. 29,570
4. Paul S. Madan, Reg. No. 33,011
5. Kaushik P. Sriram, Reg. No. 43,150
6. Gene L. Tyler, Reg. No. 35,595
7. Chandran D. Kumar, Reg. No. 48,679
8. Randall C. Furlong, Reg. No. 35,144
9. Barbara J. Tribble, Reg. No. 31,670

Please address all correspondence regarding this application to:

Customer No. 64065
Patent Services Department
Cooper Cameron Corporation
P.O. Box 1212
Houston, Texas 77251-1212

Direct all telephone calls to David L. Mossman at (512) 219-4026.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Sec. 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Named Inventor:	**David John Parkinson**
Residence:	Arodene Walton Down Walton-in-Gordano Clevedon BS21 7AR Great Britain
Post Office Address:	Same
Citizen Of:	Great Britain

_____ _____

Date **David John Parkinson**

Exhibit C

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
9 September 2005 (09.09.2005)

PCT

(10) International Publication Number
WO 2005/082541 A1

(51) International Patent Classification[7]: B04C 5/28

(21) International Application Number:
PCT/GB2005/000718

(22) International Filing Date: 25 February 2005 (25.02.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0404417.8 27 February 2004 (27.02.2004) GB

(71) Applicant *(for all designated States except US)*: **KCC GROUP LIMITED** [GB/GB]; 111 Windmill Road, Sunbury on Thames, Middlesex TW16 7EF (GB).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **PARKINSON, David, John** [GB/GB]; Arodene, Walton-in-Gordano, Clevedon, North Somerset BS21 7AR (GB).

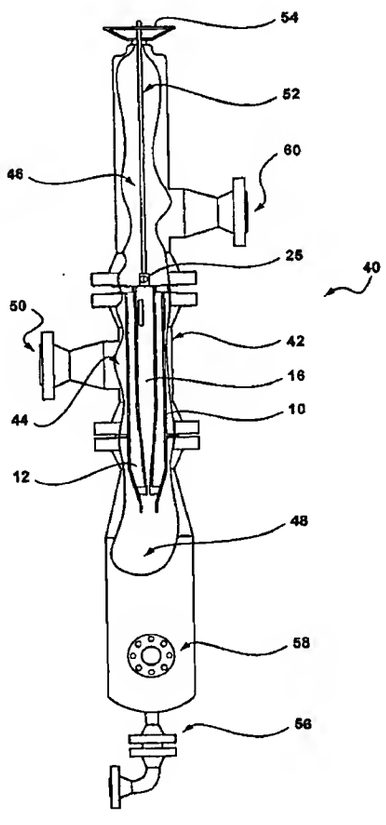
(74) Agent: **AKERS, Noel, James**; N.J Akers & Co., Grey Friars, Spring Road, Harpenden, Hertfordshire AL5 3PP (GB).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,

[Continued on next page]

(54) Title: CYCLONE ASSEMBLY AND METHOD FOR INCREASING OR DECREASING FLOW CAPACITY OF A CYCLONE SEPARATOR IN USE



(57) Abstract: A cyclone separator (40) includes a housing (42), in which a cyclone assembly (10) is contained. The housing (42) has an inflow chamber (44), an overflow chamber (46) and a discharge chamber (48). The cyclone assembly (10) has an inner cyclone liner (16) positioned concentrically within a cyclone chamber (12). A displacement means (52) is provided for displacing the inner cyclone liner (16) axially from an operative position in the cyclone chamber (12) to an inoperative position in the overflow chamber (46) of the housing (42). The cyclone chamber (12) has a larger internal diameter than the inner cyclone liner (16), therefore, when the inner cyclone liner is moved to the inoperative position, the flowrate through the cyclone assembly is increased.

WO 2005/082541 A1

FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

— *with international search report*

CYCLONE ASSEMBLY AND METHOD FOR INCREASING OR DECREASING FLOW CAPACITY OF A CYCLONE SEPARATOR IN USE

The present invention relates to a cyclone assembly and method for increasing or decreasing the flow capacity of a cyclone separator in use.

BACKGROUND

It has been known for some time that the management of solid particles, for example, sands, asphaltenes, clays, drill cuttings, and scale particles, discharged from hydrocarbon producing wells, has an important impact on downstream processing equipment. Some typical problems associated with downstream processing are:

- Wear on valves, particularly choke pressure control valves
- Drop out of solids in processing vessels such as three phase separators
- Wear on pumps and rotating equipment
- The management of separated solids on the seabed following sub-sea processing
- Disposal of solids, which are contaminated with oil offshore.

With the advent of directional drilling, which is used to seek out and produce ever more recoverable hydrocarbons from old or marginal reservoirs, and the use of lateral completions, ever increasing volumes of solids are being produced.

The use of a well head de-sander in the form of a solid/liquid cyclone housed in a pressure vessel is well known and has been utilised successfully in the offshore oil and gas exploration and production industry. A well head de-sander is typically designed to cope with slowly increasing flow rate, in order to match the field production profile of a reservoir's life. Therefore, the design must have a sufficient turndown (ie, minimum to maximum flow capacity whilst remaining an efficient separator).

Up to now, this is often been achieved in one of two ways, either by taking the de-sander off-line and changing the number of cyclone liners before returning it on-line, or by directing the flow to one or more cyclone vessels as required.

In the first method, a cyclone vessel may have the ability to hold, for example, forty cyclone liners, but has only twenty liners installed with twenty blank liners. When the flow rate through the cyclone vessel increases to the point where the pressure drop across the cyclone vessel is too high, the operator takes the cyclone vessel off line, opens it and installs more cyclone liners.

In the second method, the same effect can be achieved by having two cyclone vessels, for example, each with twenty liners installed on a skid system with valves installed on the skid manifold to allow selection of the vessels and hence number of cyclone liners on line at a given time.

In a typical example system, a well produces a volume of liquids with some associated gas, for example, 50 m^3/hr. The pressure available for use by the cyclone de-sander is typically 1bar. Cyclone liner design characteristics determine that the efficient maximum flow rate per liner whilst meeting its d_{90} cut size is given by the available pressure drop allowed divided by a constant depending on the cyclone shape size and efficiency. In this example a cyclone liner is chosen that has a maximum flow rate under these conditions of 10m^3/hr whilst separating 90% of all particles 20 microns and above that have a density equal to or greater than 2000 kg/m^3. The field's initial flow rate is considered to be 30m^3/hr and after one years operation is likely to increase to 50m^3/hr.

The cyclone vessel is therefore initially filled with three cyclone liners and two blanks. Once the pressure drop through the cyclone vessel increases to above 1 bar, the vessel is taken offline, the two blanks are removed and two extra cyclone liners are installed. The cyclone vessel is then brought back on line.

When considering a gas field, the problem of flow and pressure change is exaggerated because the gas production often begins as a low volume dense phase fluid at high pressure, and as the field matures the volume increases and the pressure drops. This therefore requires either a smaller cyclone liner type on start up, which will need to be replaced later in the field's life with a larger cyclone, or a high number of extra smaller cyclone liners in separate vessels or added to a single vessel as needs be.

Whereas these systems have had some success to date onshore and on topsides offshore, these systems are not practicable when considering sub-sea processing,

because the retrieval of a cyclone vessel for maintenance and/or the use of divers in deep sea areas are not viable.

It is therefore an object of the invention to provide a new cyclone assembly, which has an improved turndown, ie, minimum to maximum flow capacity whilst remaining an efficient separator.

STATEMENTS OF INVENTION

According to the present invention there is provided a cyclone assembly comprising a cyclone chamber, an inner cyclone liner adapted to be received within the cyclone chamber, and displacement means for displacing the inner cyclone liner relative to the cyclone chamber between an operative position and an inoperative position.

Preferably the cyclone chamber comprises an outer cyclone liner.

Preferably the inner cyclone liner is adapted to be displaced along a longitudinal axis of the outer cyclone liner between the operative position and inoperative position.

Preferably a seal is provided at a lower end of the inner cyclone liner, which seals between the inner and outer cyclone liners when the inner cyclone liner is in the operative position.

Preferably the inner cyclone liner has an inlet let into its periphery.

Preferably the outer cyclone liner has an inlet let into its periphery.

Preferably the inner cyclone liner has an overflow outlet for fluids at an upper end and a discharge outlet for solids at its lower end.

Preferably the outer cyclone liner has an overflow outlet for fluids at an upper end and a discharge outlet for solids at a lower end.

Preferably the inner cyclone liner is able to pass through the overflow outlet of the outer cyclone liner.

According to a second aspect of the present invention there is provided a cyclone separator including the cyclone assembly contained within a housing.

Preferably the housing has an inflow chamber, an overflow chamber and a discharge chamber.

Preferably a fluid supply duct is provided in fluid communication with the inflow chamber.

Preferably the cyclone chamber is substantially contained in the inflow chamber.

Preferably the inner cyclone liner can be positioned concentrically within the cyclone chamber in the operative position, or displaced axially to the inoperative position within the overflow chamber.

Preferably actuation of the displacement means is automatic, and is triggered when a predetermined pressure differential is detected between an inflow and outflow of the separator.

Preferably the displacement means is a threaded spindle. A hand wheel may be provided for actuation of the threaded spindle by rotation.

Preferably the displacement means is powered by an actuator, which may; for example, be an electric, hydraulic or pneumatic actuator.

Preferably the displacement means is powered by springs.

Preferably the displacement means is powered by the pressure differential between the inflow and outflow of the separator.

Preferably a fluidising unit is connected to the discharge chamber.

Preferably a heated jacket is provided around the separator.

Alternatively the cyclone separator is adapted to be heated by heat tracing.

The cyclone separator may be incorporated in a choke or a blow-out protector.

Preferably the cyclone separator is incorporated in a wellhead assembly or manifold.

Preferably the cyclone separator is adapted to be operated on the seabed.

Preferably the cyclone separator is adapted to be operated by a remotely controlled vehicle on the seabed.

The cyclone separator may be positioned on the seabed and arranged to remove solids from a fluid flow prior to a process or separation system.

According to a third aspect of the present invention there is provided an apparatus for treating a well head stream comprising a plurality of cyclone separators mounted on a skid, a receiving vessel for solids and a hydro-transportation device for discharging cleaned solids.

Preferably the receiving vessel for solids includes a cleaning cyclone, a re-circulation inductor and de-agglomeration means.

Preferably the de-agglomeration means is either chemical or ultrasonic.

Preferably the hydro-transportation device discharges directly into the sea or when in sub-sea operation, into a riser.

According to a fourth aspect of the present invention there is provided a method of increasing the flow capacity of a cyclone separator during use, comprising the step of withdrawing an inner cyclone liner from an operative position within a cyclone chamber to an inoperative position axially spaced from the cyclone chamber.

When the inner cyclone liner is in the inoperative position, the cyclone chamber operates alone to provide a separating function. As the cyclone chamber has a larger internal diameter than the inner cyclone liner, when the inner cyclone liner is in the inoperative position, the flowrate through the cyclone assembly is increased.

Preferably the cyclone chamber comprises an outer cyclone liner.

According to a fifth aspect of the present invention there is provided a method of reducing the flow capacity of a cyclone separator during use, comprising the step of inserting an inner cyclone liner to an operative position within an outer cyclone liner from an inoperative position axially spaced from the outer cyclone liner, thereby making the inner cyclone liner, which has a smaller internal diameter, the operative liner of the cyclone separator.

Preferably, when the inner cyclone liner is moved to the operative position, the pressure differential between the inlet and fluid outlet of the cyclone separator increases as the fluid flow capacity reduces.

The fluid flow capacity reduction and pressure increase are due to the reduction of cross-sectional area of the operative chamber of the cyclone. If the differential pressure across the inlet and outlet of the separator were to decrease or increase, without a change of liner (ie cross sectional area of the operative chamber) then a corresponding respective decrease or increase in flowrate would be expected. It is an advantage of the invention, that even with a decrease in the differential pressure, an increased flowrate can be achieved, by movement of the inner cyclone liner to the inoperative position.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described, by way of example, with reference to the accompanying drawings in which:

Fig 1 is a graph showing the relationship between pressure and flow rate for a typical gas field over a typical time period of between one and five years;

Fig 2 shows a cross-sectional view through a cyclone assembly in accordance with the invention;

Fig 3 shows a side view of a cyclone separator, partly in cross-section, including the cyclone assembly of Fig 2 with an inner cyclone liner in an operative position;

Fig 4 shows a side view of the cyclone separator of Fig 3, partly in cross-section, with the inner cyclone liner in an in-operative position; and

Fig 5 is an enlarged view of a spindle and hand wheel, also shown in Figs 3 and 4, for displacing the inner cyclone liner.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring firstly to Fig 1, in a typical gas field, the flow rate to be passed through a cyclone separator, during the course of the life of the gas field, may increase from $10m^3/hr$ to $100m^3/hr$. The pressure drop associated with such an increased flow rate is approximately from 85 bar down to 10 bar. It can therefore be seen that a cyclone separator may be required to operate over a flow rate range of $90m^3/hr$, whilst maintaining efficient separation.

Referring to Fig 2, a cyclone assembly is indicated generally at 10 and comprises a cyclone chamber 12, formed by an outer cyclone liner 14, and an inner cyclone liner 16. The inner cyclone liner 16 is adapted to be displaced along a longitudinal axis 18 of the outer cyclone liner 14 between an operative position, as viewed in Figs 2 and 3, and inoperative position, as viewed in Fig 4, and explained further below.

A seal collar 20 is provided at a lower end of the inner cyclone liner 16. The seal collar 20 is integral with the inner cyclone liner 16, and seals between the inner and outer cyclone liners when the inner cyclone liner is in the operative position.

An inlet 22 is let into the periphery of the inner cyclone liner 16, and a similar inlet 24 is let into the periphery of the outer cyclone liner 14. Each inlet 22, 24 has the shape of a vertical slot, which when supplied with a tangential fluid flow, causes swirling or a rotational flow pattern inside the respective liner 16,14.

An overflow outlet 25 for fluids is provided at an upper end of the inner cyclone liner 16 and a discharge outlet 26 is provided for solids at its lower end. Similarly, an overflow outlet 28 for fluids is provided at an upper end of the outer cyclone liner 14 and a discharge outlet 30 for solids at a lower end. The maximum diameter of the inner cyclone liner 16 is set so that the inner cyclone liner 16 can pass through the overflow outlet 28 of the outer cyclone liner 14.

An outwardly extending circumferential flange 32 is provided part-way along the outer cyclone liner 14, which enables the liner 14 to be mounted in a cyclone separator, indicated generally at 40 in Figs 3 and 4. An end cap 36, through which the overflow outlet 28 is provided, is attached to the upper end of the outer cyclone liner 14. The end cap 36 also protrudes as an outwardly extending circumferential flange, and provides further means for mounting the cyclone assembly in the cyclone separator 40.

The cyclone separator 40, see in particular Fig 3, includes a housing 42, in which the cyclone assembly 10 is contained. The housing 42 has an inflow chamber 44, an overflow chamber 46 and a discharge chamber 48. A fluid supply duct 50 is provided in fluid communication with the inflow chamber 44, where the cyclone assembly 10 is substantially contained. The inner cyclone liner 16 is positioned concentrically within the cyclone chamber 12 of the outer cyclone liner 14 in the operative position, but is contained in the overflow chamber 46 of the housing 42, when displaced axially to the inoperative position as shown in Fig. 4. The housing 42 is capable of withstanding high pressures, typically associated with oil and gas wells.

Referring also to Fig. 5, a threaded spindle 52 is connected at its lower end to the overflow outlet 24 of the inner cyclone liner 16, and passes through the upper end of the overflow chamber 46. A hand wheel 54 is provided in threaded engagement with the spindle 52, and on actuation of the hand wheel by rotation, the spindle and inner cyclone liner 16 can be axially displaced along the axis 18. Means is provided for preventing rotation of the spindle; for example, a key and keyway.

A pressure sensor and pressure indication means (not shown) is provided to enable an operator to identify when to move the inner cyclone liner 16 to the inoperative or operative position. The sensor detects the pressure differential between an inflow and outflow of the separator 40.

In a preferred embodiment of the invention, not shown, actuation of the threaded spindle 52 or other displacement means is automatic, and is triggered when a predetermined pressure differential is detected between an inflow and outflow of the separator 40. The displacement means can be powered by any suitable means, but preferably is powered by a hydraulic, pneumatic or electric actuator, by springs or by the pressure differential between the inflow and outflow of the separator.

A fluidising unit can be connected to the discharge chamber 48 by means of a fluidising unit feed duct 56 and a solids outlet duct 58. The fluidising unit creates a localised swirling flow which breaks up agglomeration and entrains particles into an outlet flow of well stream fluids. Separated well stream fluids flow out through an outlet duct 60, which is in fluid connection with the overflow chamber 46.

In order to facilitate flow of fluid, particularly hydrocarbons, through the separator 40, a heated jacket (not shown) can be provided around the separator. Alternatively the cyclone separator 40 is adapted to be heated by heat tracing.

In use, the cyclone separator 40 can be incorporated in a choke or a blow-out protector, or in a wellhead assembly or manifold. The separator 40 can also be adapted to be operated on the seabed, by means of a remotely controlled vehicle. When positioned on the seabed, the cyclone separator 40 can be arranged to remove solids from a fluid flow prior to a process or separation system.

In a further preferred embodiment of the invention for treating a well head stream (not shown), a plurality of cyclone separators can be mounted on a skid, together with a receiving vessel for solids and a hydro-transportation device for discharging cleaned solids. The receiving vessel for solids preferably includes a cleaning cyclone, a re-circulation inductor and de-agglomeration means. The de-agglomeration means is either chemical or ultrasonic. In use, the hydro-transportation device discharges directly into the sea or when in sub-sea operation, into a riser.

In use, the flow capacity of the cyclone separator 40 can be increased by withdrawing the inner cyclone liner 16 from its operative position within the outer cyclone liner 14, as shown in Figs 2 and 3, to the inoperative position axially spaced from the outer cyclone liner 14, thereby making the outer cyclone liner 14, which has a larger internal diameter, the operative liner of the cyclone separator 40.

The result is that the pressure differential between an inlet and an outlet of the cyclone separator reduces even though the flowrate through the separator increases. Furthermore, the flow capacity of the cyclone separator can be reduced during use, by inserting the inner cyclone liner 16 to an operative position within the outer cyclone liner 14 from the inoperative position axially spaced from the outer cyclone liner,

thereby making the inner cyclone liner, which has a smaller internal diameter, the operative liner of the cyclone separator. In this case, the pressure between an inlet and an outlet of the cyclone separator increases as the flow capacity reduces.

When the inner cyclone liner 16 is in the operative position, rotational flow in the flooded cyclone chamber 12 of the outer cyclone liner 14 passes through the inlet 22 of the inner cyclone liner 16, causing a rotational flow pattern therein. In other words, the outer cyclone liner 14, of larger diameter, acts as a flow distributor to the inlet 22 of the inner cyclone liner 16. Solid particles separated from the flow report to the discharge chamber 48, where they are removed by fluidising using a low fluid flow rate to create a vortex action. This fluidises the solids and causes them to report to the solids outlet duct 58 at a controllable velocity and concentration. Treated or separated fluids, typically hydrocarbon fluids, pass through the outlet duct 60.

The inner cyclone liner 16 should be displaced to the inoperative position when the cyclone separator 40 witnesses a high pressure drop across the system that indicates that the inner cyclone liner 16 taking the flow is too small or has insufficient area or volume for the unit to pass the incoming flow rate, whilst maintaining the required separation efficiency at the designed pressure drop. When in the inoperative position, the inner cyclone line 16 does not interfere with the flow through the larger outer cyclone liner 14. The effect is to decrease the pressure drop through the cyclone separator or de-sander to acceptable levels whilst maintaining desired flow rates and separation efficiencies.

It is an advantage of the invention that the inner cyclone liner 16 can be displaced during operation of the cyclone separator 40, ie, when it is online. Furthermore, the automatic operation of the displacement means enables most efficient operation of the separator.

The scope of the invention is intended to include any arrangement in which a plurality of cyclone assemblies or cyclone separators are incorporated in a treatment system in series or in parallel connection.

CLAIMS

1. A cyclone assembly comprising a cyclone chamber, an inner cyclone liner adapted to be received within the cyclone chamber, and displacement means for displacing the inner cyclone liner relative to the cyclone chamber between an operative position and an inoperative position.

2. A cyclone assembly as claimed in claim 1 in which the cyclone chamber comprises an outer cyclone liner.

3. A cyclone assembly as claimed in claim 2 in which the inner cyclone liner is adapted to be displaced along a longitudinal axis of the outer cyclone liner between the operative position and inoperative position.

4. A cyclone assembly as claimed in claim 3 in which a seal is provided at a lower end of the inner cyclone liner, which seals between the inner and outer cyclone liners when the inner cyclone liner is in the operative position.

5. A cyclone assembly as claimed in any preceding claim in which the inner cyclone liner has an inlet let into its periphery.

6. A cyclone assembly as claimed in any one of claims 2 to 5 in which the outer cyclone liner has an inlet let into its periphery.

7. A cyclone assembly as claimed in any preceding claim in which the inner cyclone liner has an overflow outlet for fluids at an upper end and a discharge outlet for solids at its lower end.

8. A cyclone assembly as claimed in any one of claims 2 to 7 in which the outer cyclone liner has an overflow outlet for fluids at an upper end and a discharge outlet for solids at a lower end.

9. A cyclone assembly as claimed in claim 8 in which the inner cyclone liner is able to pass through the overflow outlet of the outer cyclone liner.

10. A cyclone separator including a cyclone assembly as claimed in any one of claims 1 to 9 in which the cyclone assembly is contained within a housing.

11. A cyclone separator as claimed in claim 10 in which the housing has an inflow chamber, an overflow chamber and a discharge chamber.

12. A cyclone separator as claimed in claim 11 in which a fluid supply duct is provided in fluid communication with the inflow chamber.

13. A cyclone separator as claimed in claim 11 or claim 12 in which the cyclone chamber is substantially contained in the inflow chamber.

14. A cyclone separator as claimed in any one of claims 11 to 13 in which the inner cyclone liner can be positioned concentrically within the cyclone chamber in the operative position, or displaced axially to the inoperative position within the overflow chamber.

15. A cyclone separator as claimed in any one of claims 10 to 14 in which actuation of the displacement means is automatic, and is triggered when a predetermined pressure differential is detected between an inflow and outflow of the separator.

16. A cyclone separator as claimed in any one of claims 10 to 15 in which the displacement means is a threaded spindle.

17. A cyclone separator as claimed in any one of claims 11 to 14 in which the displacement means is a threaded spindle and a hand wheel is provided for actuation of the threaded spindle by rotation.

18. A cyclone separator as claimed in any one of claims 10 to 16 in which the displacement means is powered either by a hydraulic or pneumatic actuator.

19. A cyclone separator as claimed in any one of claims 10 to 16 in which the displacement means is powered by an electric actuator.

20. A cyclone separator as claimed in any one of claims 10 to 16 in which the displacement means is powered by springs.

21. A cyclone separator as claimed in claim 15 in which the displacement means is powered by the pressure differential between the inflow and outflow of the separator.

22. A cyclone separator as claimed in any one of claims 11 to 21 in which a fluidising unit is connected to the discharge chamber.

23. A cyclone separator as claimed in any one of claims 9 to 22 in which a heated jacket is provided around the separator.

24. A cyclone separator as claimed in any one of claims 9 to 22 in which the cyclone separator is adapted to be heated by heat tracing.

25. A cyclone separator as claimed in any one of claims 9 to 24 in which the cyclone separator is incorporated in a choke or a blow-out protector.

26. A cyclone separator as claimed in any one of claims 9 to 24 in which the cyclone separator is incorporated in a wellhead assembly or manifold.

27. A cyclone separator as claimed in any one of claims 9 to 24 in which the cyclone separator is adapted to be operated on the seabed.

28. A cyclone separator as claimed in claim 27 in which the cyclone separator is adapted to be operated by a remotely controlled vehicle on the seabed.

29. A cyclone separator as claimed in claim 27 or claim 28 in which the cyclone separator is positioned on the seabed and arranged to remove solids from a fluid flow prior to a process or separation system.

30. An apparatus for treating a well head stream comprising a plurality of cyclone separators as claimed in any one of claims 9 to 24 mounted on a skid, a receiving vessel for solids and a hydro-transportation device for discharging cleaned solids.

31. An apparatus for treating a well head stream as claimed in claim 30 in which the receiving vessel for solids includes a cleaning cyclone, a re-circulation inductor and de-agglomeration means.

32. An apparatus for treating a well head stream as claimed in claim 31 in which the de-agglomeration means is either chemical or ultrasonic.

33. An apparatus for treating a well head stream as claimed in any one of claims 30 to 32 in which the hydro-transportation device discharges directly into the sea or when in sub-sea operation, into a riser.

34. A method of increasing the flow capacity of a cyclone separator during use, comprising the step of withdrawing an inner cyclone liner from an operative position within a cyclone chamber to an inoperative position axially spaced from the cyclone chamber.

35. A method as claimed in claim 34 in which the pressure between an inlet and an outlet of the cyclone separator reduces as the flow capacity increases.

36. A method of reducing the flow capacity of a cyclone separator during use, comprising the step of inserting an inner cyclone liner to an operative position within an outer cyclone liner from an inoperative position axially spaced from the outer cyclone liner, thereby making the inner cyclone liner, which has a smaller internal diameter, the operative liner of the cyclone separator.

37. A method as claimed in claim 36 in which the pressure between an inlet and an outlet of the cyclone separator increases as the flow capacity reduces.

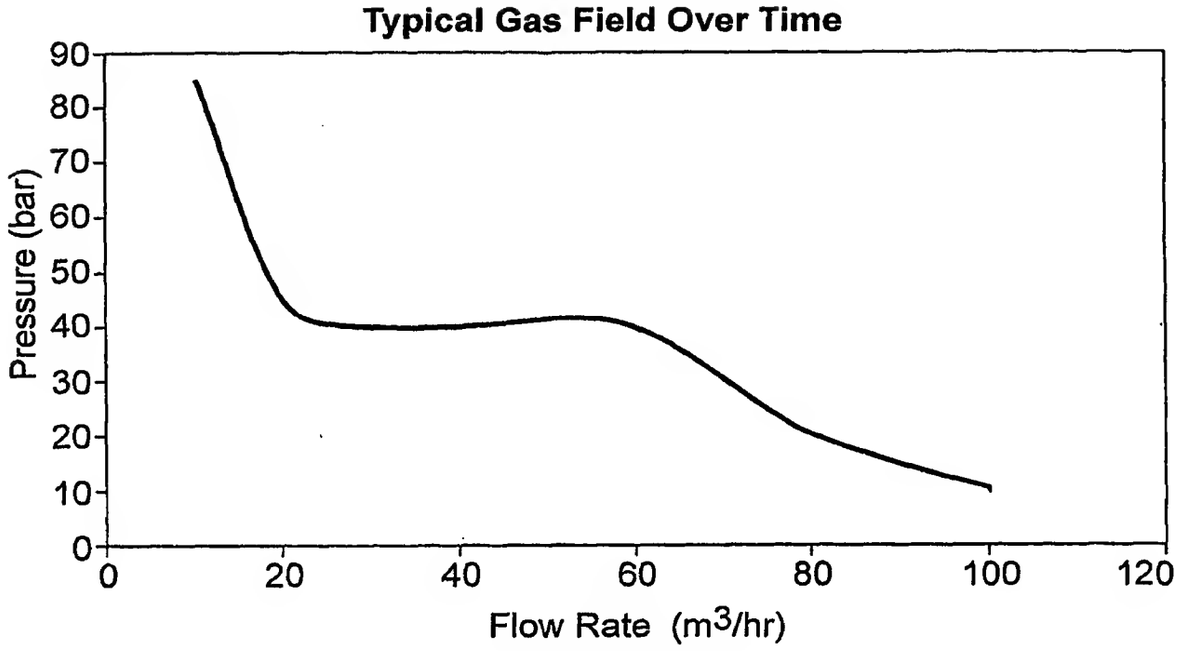

Typical Gas Field Over Time
Pressure (bar)
90
80
70
60
50
40
30
20
10
0
0
20
40
60
80
100
120
Flow Rate (m3/hr)

Figure 1

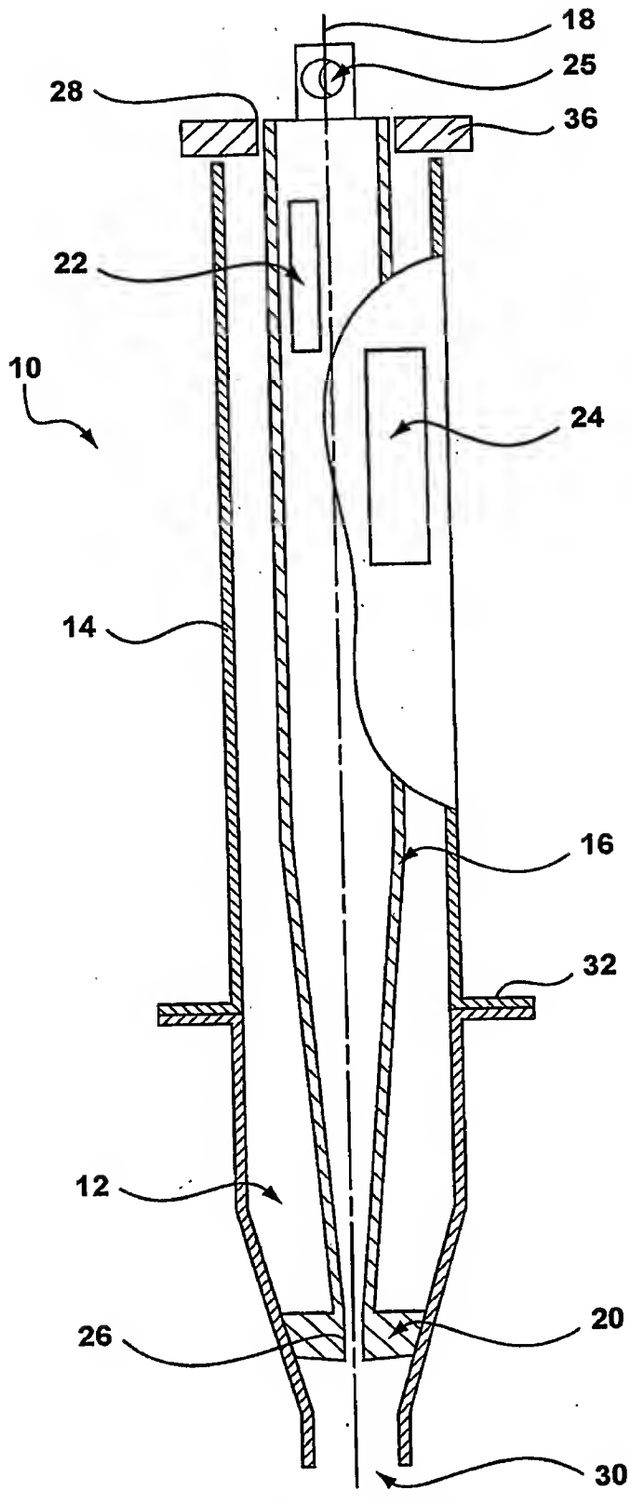


Figure 2

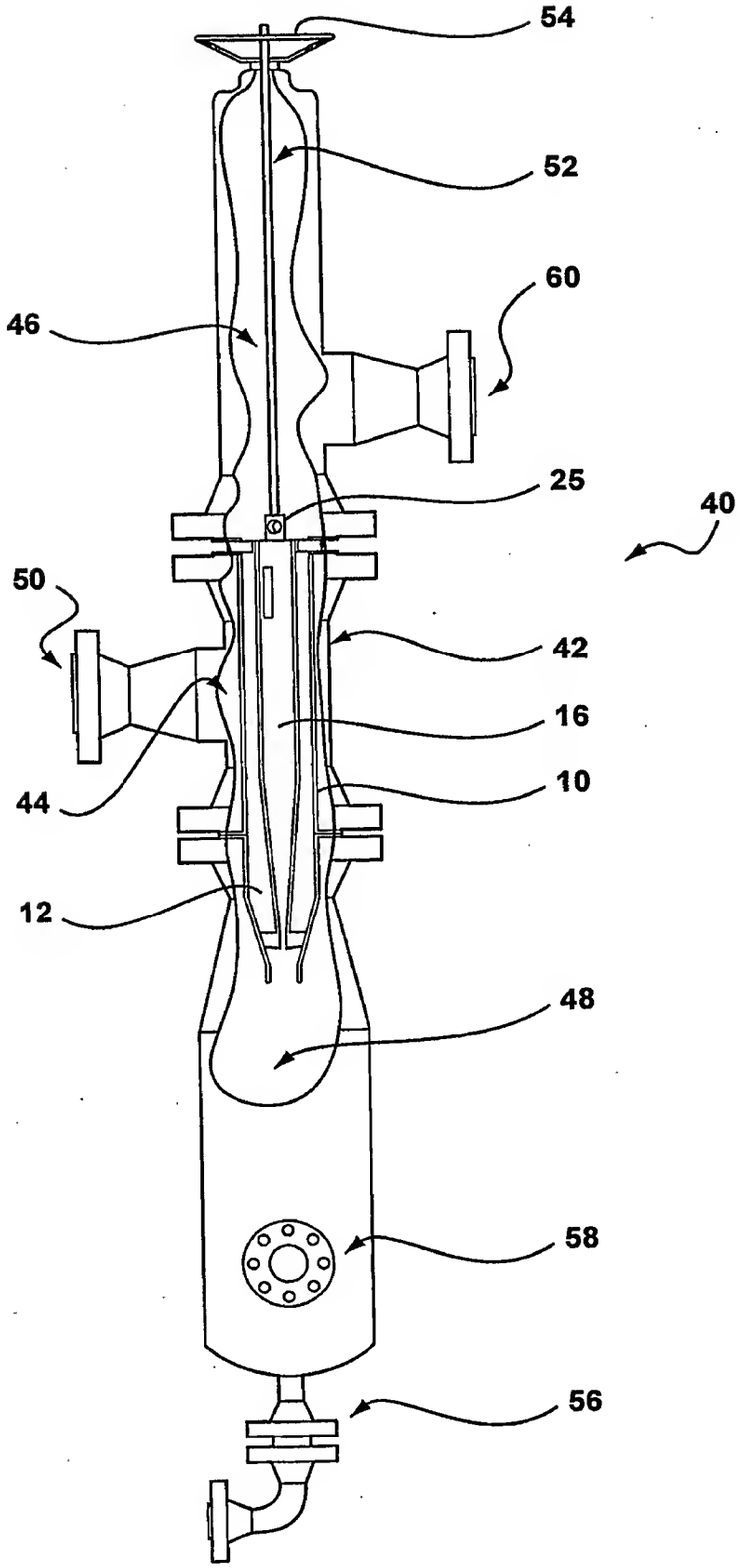


Figure 3

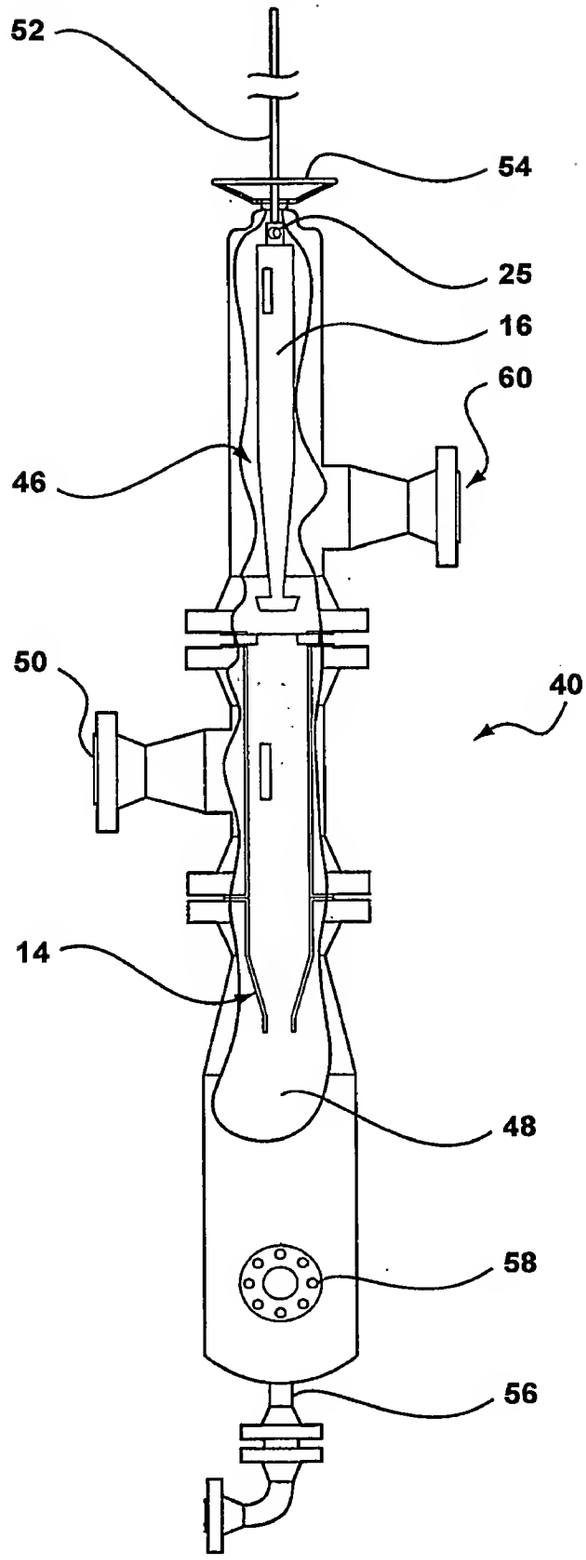


Figure 4

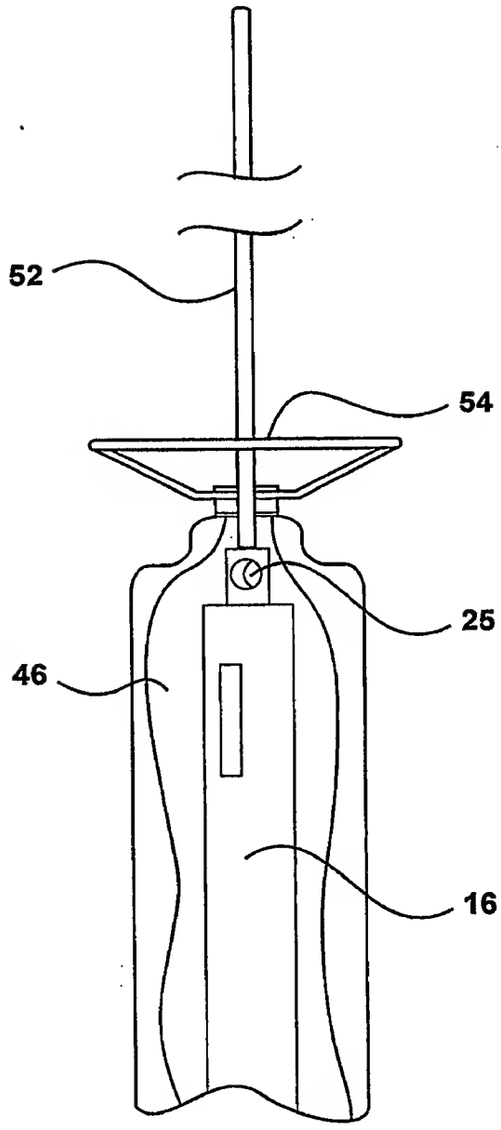


Figure 5

INTERNATIONAL SEARCH REPORT

PCT/GB2005/000718

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B04C5/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B04C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 789 476 A (SCHULZ ET AL) 6 December 1988 (1988-12-06) column 1, line 6 - line 17 column 7, line 43 - column 8, line 36 figures 1-10	1,10,30, 34,36
A	US 2 209 339 A (KNIGHT ALFRED W) 30 July 1940 (1940-07-30) page 1, left-hand column, line 1 - line 10 page 1, left-hand column, line 53 - page 1, right-hand column, line 8 page 2, right-hand column, line 74 - page 3, right-hand column, line 23 figures 3-5	1,10,30, 34,36

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

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"E" earlier document but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 May 2005	19/05/2005

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Redelsperger, C

Form PCT/ISA/210 (second sheet) (January 2004)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 006, no. 078 (C-102), 15 May 1982 (1982-05-15) & JP 57 015858 A (KANDA KINZO), 27 January 1982 (1982-01-27) abstract	1,10,30, 34,36

INTERNATIONAL SEARCH REPORT

Information on patent family members

PCT/GB2005/000718

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 4789476	A	06-12-1988	DE	3509789 A1	30-10-1986
			DE	3607023 A1	10-09-1987
			AT	43976 T	15-06-1989
			DE	3663890 D1	20-07-1989
			WO	8605417 A1	25-09-1986
			EP	0215075 A1	25-03-1987
US 2209339	A	30-07-1940	DE	729544 C	18-12-1942
JP 57015858	A	27-01-1982	NONE		

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Web: www.njakers.com

Exhibit E

Mr. David Parkinson
C/o DPS (Bristol) Ltd
Serbert Way
Portishead
Bristol
BS20 7GF

COPY

Via special delivery

17 September, 2007

Dear Mr. Parkinson

Our firm represents Cooper Cameron, Petreco International and KCC Group Limited with regard to Intellectual Property including various patent matters.

Further to recent correspondence we would be most grateful if you could review and sign appropriately the enclosed combined Declaration and Power of Attorney for the US. As you may be aware these documents are required under American law for patents filed in the United States of America.

Please could you sign the document as indicated and return to us via the enclosed SAE as a matter of some urgency. If you have any queries regarding this document please do not hesitate to contact Mr. Noel Akers of this office.

I also enclose a copy of the PCT publication involved in this case, WO 2005/082541 A1.

Your assistance in this matter is greatly appreciated.

Yours sincerely

Sarah Irish

Encl: Assignment
Power of Attorney

Exhibit F

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Sarah Irish

Exhibit G

From: Sarah Irish [irish@njakers.com]
Sent: 17 September 2007 12:27
To: 'davidparkinson@dps-global.com'
Subject: Assignment
Importance: High

COPY

Dear Mr. Parkinson,

Our firm represents Cooper Cameron, Petreco International and KCC Group Limited with regard to Intellectual Property including various patent matters.

Further to recent correspondence we would be most grateful if you could review and sign appropriately the attached combined Declaration and Power of Attorney for the US. As you may be aware these documents are required under American law for patents filed in the United States of America.

Please could you sign the document as indicated and return to us as a matter of some urgency. If you have any queries regarding this document please do not hesitate to contact Mr. Noel Akers of this office.

I also attach a copy of the PCT publication involved in this case, WO 2005/082541 A1.

Your assistance in this matter is greatly appreciated.

Please could you indicate if you are in a position to sign this document and, if so, when we might expect to receive these documents back from you?

Kind regards

Sarah Irish

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Truro
Cornwall, TR1 3JG
United Kingdom

Tel: + 44 (0) 1872 266 810
Fax: + 44 (0) 1872 262 611

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Web: www.njakers.com

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Registered in England and Wales with company number 5147141

Exhibit H

Sarah Irish

From: postmaster@dps-global.com
Sent: 17 September 2007 12:33
To: irish@njakers.com
Subject: Delivery Status Notification (Success)


details.txt (374 B)


Assignment (1.01 MB)

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